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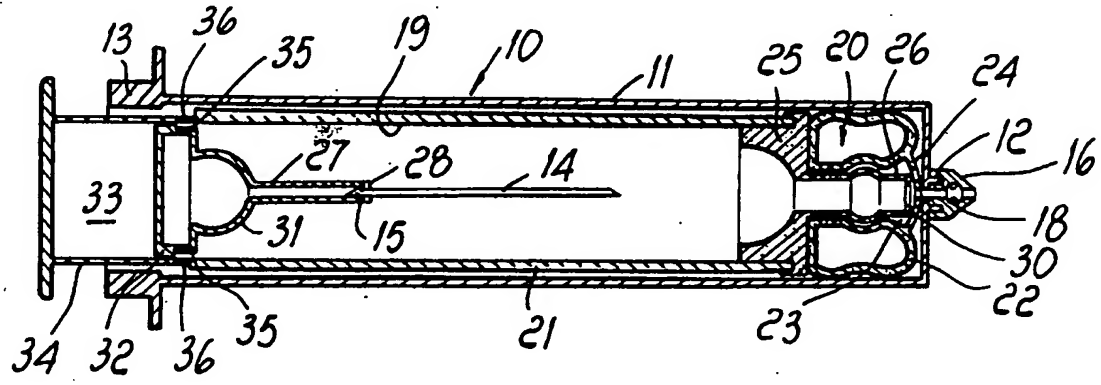
(54) Title: HYPODERMIC INJECTION SYRINGE PROVIDED WITH A PLUNGER ABLE TO RETRACT AND CONTAIN THE HYPODERMIC NEEDLE AFTER USE



(57) Abstract

A syringe is described provided with an engagement device which at the end of the plunger travel becomes connected to the hypodermic needle and to a pneumatic actuator, preferably of vacuum type, arranged to cause said needle to enter an appropriate chamber in the plunger after use.

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HYPODERMIC INJECTION SYRINGE PROVIDED WITH A PLUNGER ABLE TO RETRACT AND CONTAIN THE HYPODERMIC NEEDLE AFTER USE

Field of the invention

This invention relates to a syringe provided with an engagement device able to cause the hypodermic needle to enter a cavity in the plunger shaft when the injection has been completed.

State of the art

The problem of making a hypodermic syringe needle innocuous is currently important because of the serious problems of infection connected with accidental pricking with used and thus infected syringe needles, a problem which is exacerbated because many syringes designed for once-only use can in fact be used more than once.

Italian patent application No. 9543 A/88 of the present applicants describes a syringe in which, after use, the needle is made to enter a cavity in the plunger by means of a tension spring, one end of which is fixed to the inner surface of the plunger and which becomes operationally connected to a support member provided with a pawl able to engage the needle at the end of the plunger stroke and to pull it into said cavity.

Although effective, this device has certain constructional problems which make it difficult to implement in that the tension spring has to be fixed to the interior of the plunger, as stated.

Summary of the invention

The present invention enables a similar result to be obtained in a manner which considerably simplifies the construction and/or assembly of the syringe.

The syringe according to the present invention is formed from a cylindrical body, a plunger slidable within said cylindrical body and provided with a hollow shaft defining an inner chamber, and a hollow needle or metal cannula connected to said cylindrical body by first means which shear under a determined load, said syringe being characterised by comprising an engagement device which is connected to said plunger by second means which shear under a determined load at the end of travel of said plunger, and becomes operationally connected at the end of travel of the plunger to said needle and to a pneumatic actuator able to cause said needle to enter said chamber in the shaft of said plunger.

According to a preferred embodiment said pneumatic actuator is of the vacuum type, said plunger advantageously being provided with a hollow shaft defining an inner chamber in which vacuum is created and in which a piston rigid with said engagement device is slidable under sealed conditions.

With the proposed arrangement the syringe construction is simplified and its performance and reliability are optimized.

Detailed description of the invention

These and further advantages and innovative and operational characteristics of the present invention will be more apparent to the expert of the art with the aid of the accompanying Figures 1 to 5 which are given by way of non-limiting example, and of which:

Figure 1 is a partly sectional view of the syringe according to the invention;
Figure 2 is an axial section through the syringe during use;
Figure 3 shows the syringe of Figure 2 after use, with the needle retracted;
Figure 4 shows the syringe of Figure 2 during assembly;

Figure 5 shows a detail of the syringe of Figure 2 to an enlarged scale.

In Figures 1 to 4 the reference numeral 10 indicates overall a hypodermic syringe constructed in accordance with the invention, and 11 indicates its cylindrical body, which is provided with a neck 12 and a guide ring 13.

The reference numeral 14 indicates a double-ended hollow needle 14 or metal cannula, provided with an engagement recess 15 and made rigid with the base 16 by a ring 18 or washer of a material which shears under a predetermined load; the base 16 is fixed to the neck 12 of the body 11.

The reference numeral 19 indicates overall the plunger which is slidable within the body 11 and is provided with a head 20 and a hollow shaft 21.

The head 20 of the plunger 19 is formed from a ring 22 of particularly elastic rubber, the channel 23 of which is closed by a disc 24 of easily shearable material.

The head 20 is fixed in a sealed manner to the shaft 21 of the plunger 19 by a plug 25 provided with a tube 26, which is forcibly inserted into the channel 23 of the rubber ring 22.

The reference numeral 27 indicates an engagement rod with which a disc 28 provided with an X-shaped cut forming elastic flaps 29, visible in Figure 5, is rigid.

The rod 27 is fixed to the tube 26 by a washer 30 of a material which shears under a predetermined load.

The rod 27 is rigidly connected by the hemispherical connector 31 to a piston 32, which is slidable in a sealed manner within the cylindrical chamber 33 of the hollow shaft 21.

The sealed sliding of the piston 32 in the chamber 33 is obtained either by the sealing contact between the contacting surfaces or, if necessary, by mounting a suitable seal ring on the piston 32.

A predetermined vacuum is provided in the chamber 33 of the hollow shaft 21.

The hollow shaft 21 has an end portion 34 of reduced outer diameter in order to reduce the resistance arising from contact with the inner wall of the guide ring 13 during the final part of the travel of the plunger 19.

The reference numeral 35 indicates two magnets incorporated in the piston 32 and 36 indicates two further magnets incorporated in the shaft 21 in proximity to the portion 34.

The pairs of magnets 35 and 36 have opposite polarities so that they attract each other.

When the syringe 10 is in use and the plunger 19 is about to finish its injection stroke, as shown in Figures 1 and 2, the disc 24 is lacerated by the inner point of the needle 14, the rod 27 then engaging the needle via the disc 28, the elastic flaps 29 of which engage the recess 15 in the needle 14.

The thrust exerted by the operator on the plunger 19 during the final part of the injection stroke to ensure that the liquid to be injected is completely expelled causes the washer 30 to break, thus releasing the rod 27 and the piston 32 from the plunger head 20. Under these conditions, under the action of the vacuum present in the chamber 33, the piston 32, the rod 27 and the needle engaged with it are sucked into the chamber 33, where they are retained by the mutual attraction of the pairs of magnets 35 and 36, as shown in Figure 3.

The needle 14 cannot be reused and the syringe 10 is therefore rendered innocuous.

Constructional modifications of the syringe 10 fall within the scope of the present invention; for example the needle engagement device could be other than the rod 27 and disc 28; the vacuum chamber 33 could be in the form of a container housed in the hollow shaft 21.

The advantages of the present invention are the extreme ease of construction and assembly of the syringe, which in its external appearance hardly does not differ from the normal commercially available disposable syringes, but has the advantage that the fact that the needle disappears into its interior after use makes it innocuous and truly usable only once.

PATENT CLAIMS

1. A hypodermic injection syringe formed from a cylindrical body (11), a plunger (19) slidable within said cylindrical body and provided with a hollow shaft (21) defining an inner chamber, and a hollow needle (14) or metal cannula connected to said cylindrical body by first shearable means (18), said syringe being characterised by comprising an engagement device (27, 28, 29) which is connected to said plunger (19) by second means (30) which shear under a determined load at the end of travel of said plunger, and becomes operationally connected at the end of travel of the plunger to said needle (14) and to a pneumatic actuator (32, 33) able to cause said needle to enter said chamber (33) in the shaft of said plunger.

2. A syringe as claimed in claim 1, characterised in that said pneumatic actuator (32, 33) is of vacuum type.

3. A syringe as claimed in claim 1, characterised in that said plunger (19) is provided with a hollow shaft (21) having an inner chamber in which vacuum is created and in which a piston (32) rigid with said engagement device (27, 28, 29) is slidable under sealed conditions.

4. A syringe as claimed in claim 1, characterised in that said engagement device (27, 28, 29) consists of a rod (27) rigid with a disc (28) provided with an X-shaped cut forming elastic flaps (29) engagable with a recess (15) in said needle (14).

5. A syringe as claimed in claims 1 and 4, characterised in that said second shearable means (30) are a washer fixed to said rod (27) and to the head (20) of the plunger (19) and constructed of a material which shears under a determined load.

6. A syringe as claimed in claim 1, characterised in that said first shearable means (18) consist of a ring (18) constructed of a material shearing under a determined load, and rigid with

said needle (14) and with a base (16) which is fixed to the cylindrical body (11).

7. A syringe as claimed in claim 3, characterised in that said piston (32) and said hollow shaft (21) are provided with at least one pair of magnets (35, 36) arranged to attract each other.

8. A syringe as claimed in claim 3, characterised in that said plunger (19) comprises an end portion (34) of reduced diameter to reduce the contact with a guide ring (13) with which said cylindrical body (11) is provided.

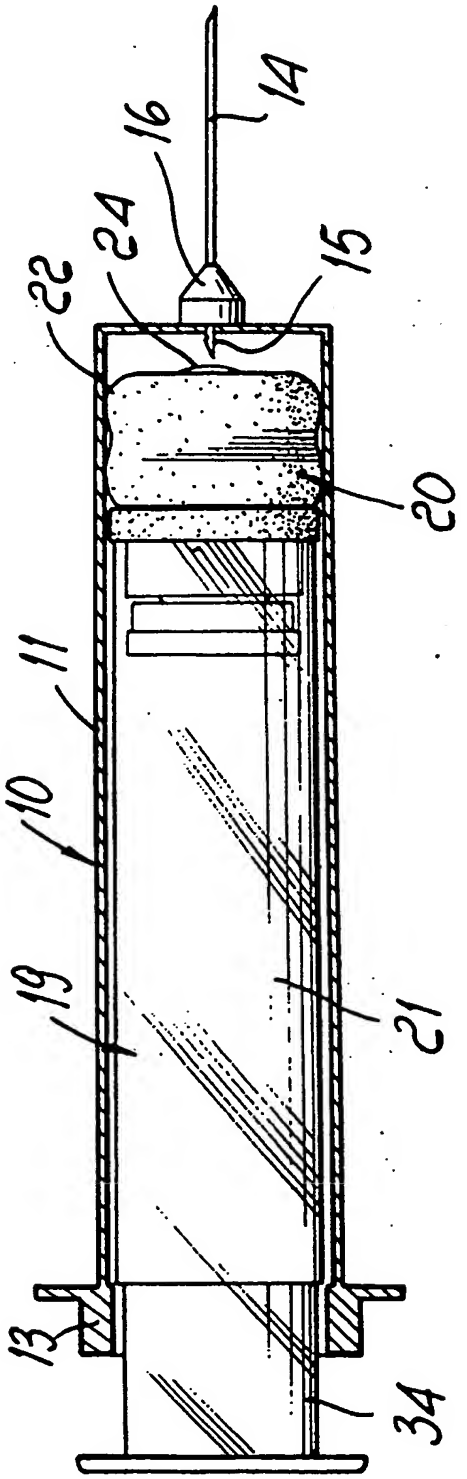

FIG. 1

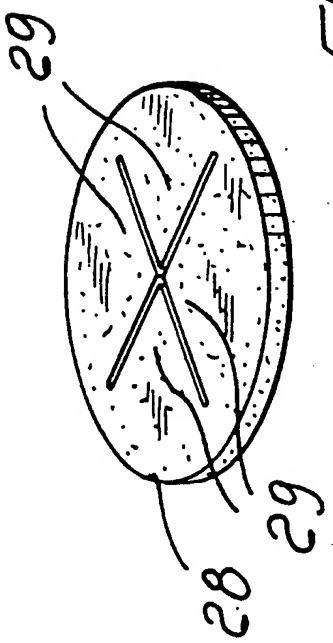

FIG. 5

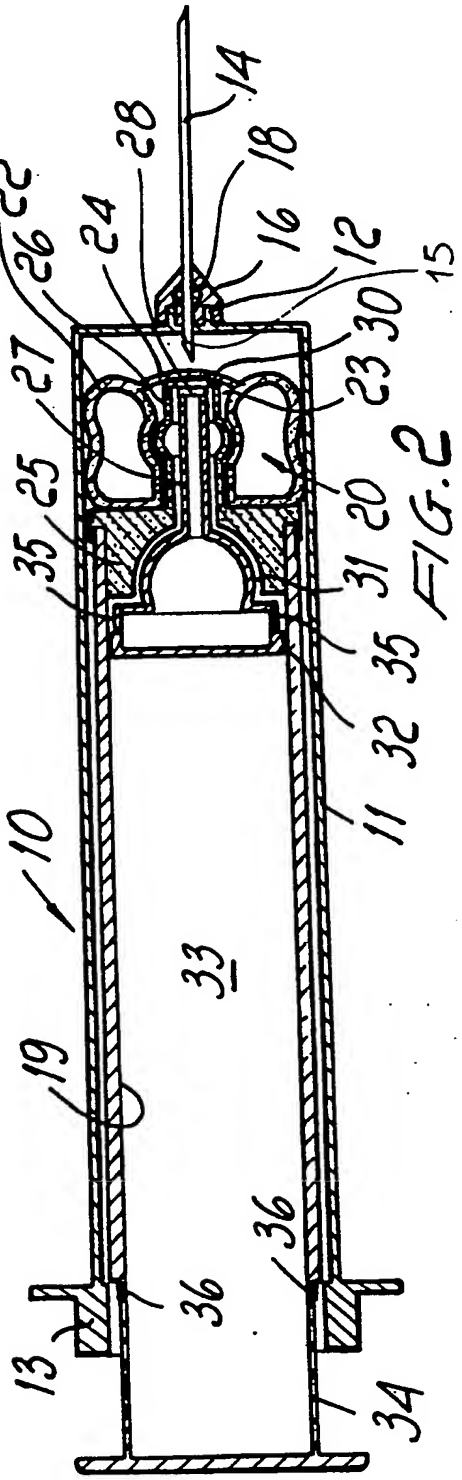
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FIG. 2

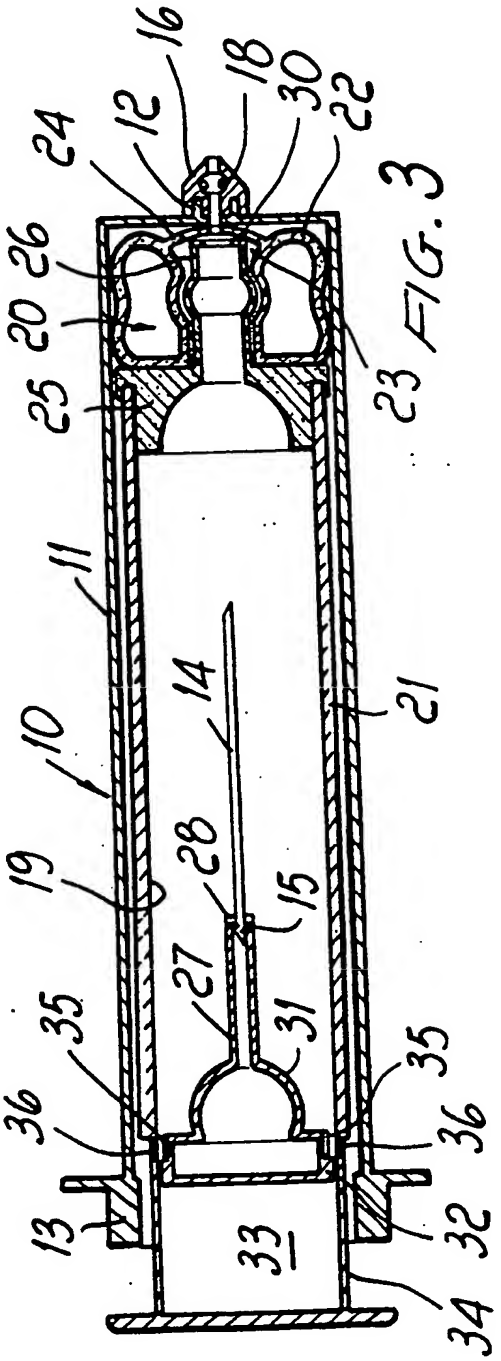
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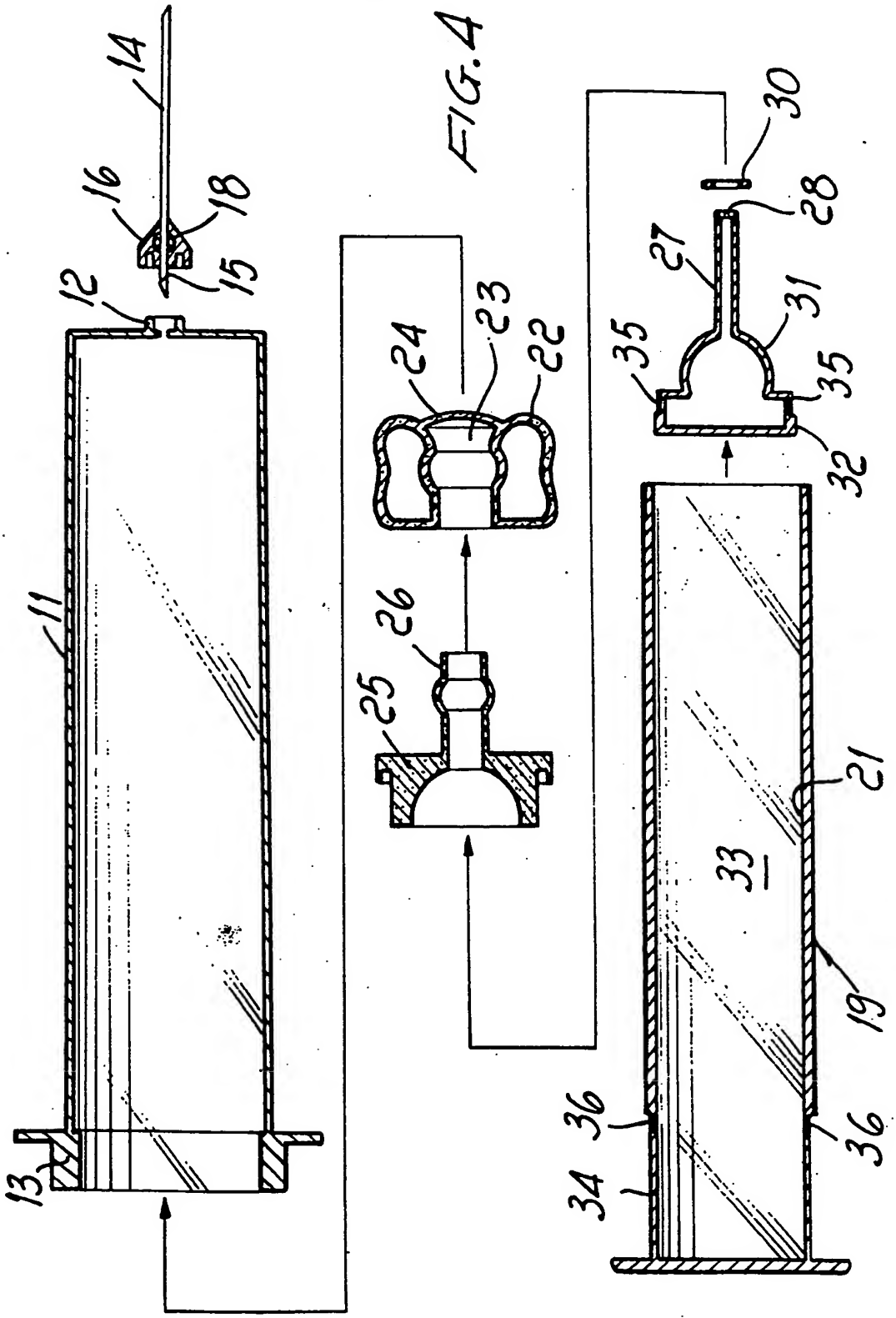
FIG. 3

FIG. 4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INTERNATIONAL SEARCH REPORT

International Application No PCT/EP 91/00005

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[5]: A 61 M 5/32

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[5]	A 61 M

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	WO, A, 8900435 (GAARDE) 26 January 1989 see page 4, line 12 - page 5, line 30; claim 1; figure 1	1-3
Y	US, A, 4772265 (WALTER) 20 September 1988 see claim 1	1-3
A	WO, A, 8909075 (DAVSA SEVENTY-FIFTH PTY LTD) 5 October 1989 see page 6, line 3 - page 7, line 7; claim 1, figure 3	1,4

* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
25th March 1991	25. 04. 91
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A- 8900435	26-01-89	EP-A- 0367780	16-05-90
		JP-T- 2504114	29-11-90
US-A- 4772265	20-09-88	US-A- 4828548	09-05-89
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